contents; a thickness of stone doubled (for no reason) and multiplied by the power or logarithm of another quantity to get a lineal quantity; a series of different breadths in inches added together (p. 178) ×10, compared with the number of theoretic pounds in a theoretic ton; or the number of lineal inches in a dimension (p. 187) shown to be the same as the number of grains in a theoretic cubic inch of an arbitrary specific gravity. No rational sense can be attached to such processes; they are numerical coincidences, and can have no meaning. When a very large number of quantities, of multipliers, and of processes of connection can thus be handled, and a wide latitude is allowed for the exactitude of the results, there is no reason for the product ceasing at 217 pages; it might as easily be continued to infinity.

The starting point is the boss of granite—one of the well-known lugs for stone lifting, the remains of many of which may be seen on other stones in the pyramid. The dimensions of this vary from 4·7 to 5·2 inches wide, and 0·94 to 1·1 inches thick, the faces being roughly hammer-dressed. This is then assumed to be exactly five inches wide and an inch thick. It is then assumed that at its junction with the stone face it is 7×5 inches; though rounded at the top, it is assumed to be rectangular, and an assumed unit of thirty-five cubic inches is deduced, and then used as a basis for pages of subsequent theory. Any one of the certainly wrong assumptions that are made would leave the conclusion entirely in air. But it serves as an efficient basis for an elaborate gnosis, interesting as a revelation of mental method.

Matters unknown to the author are also elaborated. We read of "those most exact and artistically prepared corner sockets," which are really vague and irregular in every part except the truly flat floor. The cubic content of a socket, which is sunk in a wavy, irregular surface of natural rock, is calculated, and, ÷2, the cubic inches equal the lineal inches in a theoretic mile. The faces of the pyramid are assumed to be concave in order to fill up the corners of the rock-cut sockets, and many pages of theory result from this assumption; yet at the north-east corner the drawn line of the base can be seen running some inches within the side of the socket, showing that the face was straight.

Not only does such wishing serve instead of facts to the gnostic mind, but it may entirely obliterate facts. We read, p. 17, of "the introduction of the French metric system with complete subversion and abandonment of all our hereditary measures." Yet, strange to say, the old English mile is two kilometres, the furlong 200 metres, the chain 20 metres, and the fathom two metres, or building yard one metre, within the small uncertainty of our knowledge; and this system is based on a foot, which was not only known widely in the north back to Roman times, but was known to foreigners in Egypt for thousands of years earlier. It is curious that the metric system was thus closely anticipated, and it is exactly contrary to our author's statements.

Points at issue might be raised innumerably, but it would be useless to do so. The type of mind that is nourished by such material transcends the usual limits of facts and proofs, and remains for us as one of the interesting specimens in the museum of psychology.

W. M. F. P.

THE ANTHRACITE OF SOUTH WALES.

The Coals of South Wales, with Special Reference to the Origin and Distribution of Anthracite. By Aubrey Strahan and W. Pollard. Pp. vi+78. Memoirs of the Geological Survey of England and Wales. (London: H.M. Stationery Office, 1908.) Price 1*s.* 6*d.*

THIS memoir gives the results of an investigation into the character of the coals of South Wales. The collection of the material was begun in 1901, and the work has now so far progressed as to lead to an opinion as to the relative distribution of anthracitic and bituminous coals, and as to the origin of the difference between them. The results published include not only the analyses made for the purposes of the investigation by Mr. Pollard, Mr. E. G. Radley and Mr. C. A. Seyler, but also all previous trustworthy analyses of coal from recognisable seams. The total number of analyses is 203. In each case the particulars given include the local name of the seam, the colliery, the authority, the percentages of carbon, hydrogen, oxygen and nitrogen, the ratio of carbon to hydrogen, the percentages of volatile matter, and ash, the specific gravity, and the fuel ratio or the relation of fixed carbonaceous residue to volatile matter.

In view of the importance of considering the analyses of each seam separately, it was necessary to correlate, so far as possible, the seams of one part of the coalfield with those of another. The sequence of the seams has consequently received careful attention, and a plate of sections is given showing the position and correlation of the seams. The different bands of the same seam are compared, and the results are given of a comparison of different samples from the same seam in the same locality, as well as of different seams in the same locality. Other chapters deal with the analytical methods employed, with the accuracy of coal analyses and with the classification of coals.

Of the ten plates accompanying the memoir, five are iso-anthracitic charts designed to show areas of equal anthracitism in each seam or group of seams. The degree of anthracitism of each sample is expressed by the factor representing the relation of carbon to hydrogen. Among previous investigators there is a general agreement that the anthracitic character of the coals in part of the coalfield has resulted from a change effected upon coals which had been originally bituminous. Three explanations of the change have been put forward: (1) that the anthracitic seams have been more deeply buried and consequently exposed to a higher temperature; (2) that they have been altered by adjacent plutonic rocks; and (3) that they are more affected by slip-cleavage. To these three theories there are serious

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objections, and the investigations now recorded tend to show (1) that the seams are not all similarly anthracitic, and though each seam is generally more anthracitic than the one above it, there are many exceptions to the rule; (2) that the anthracitic character was not due to faults, but existed before the faults were formed; (3) that the anthracite existed as such before the coalfield was reduced by denudation to its present dimensions; and (4) that the percentage of ash diminishes *pari passu* with the decrease of bituminous matter. These conclusions point to the variations in the composition of the coals having been either original or at least of very early date. Indeed, of all the suggested causes of alteration subsequent to deposition, none appear to have been adequate to produce more than a slight modification of the differences due to original composition.

Written in faultless literary style and edited with scrupulous accuracy, this valuable addition to geological literature will appeal to a wide circle of readers, and the authors deserve great credit for the success they have achieved in the first attempt to define the distribution of anthracite and to explain its origin on purely experimental grounds.

VITALISM.

Versuch einer Begründung der Deszendenztheorie. By Prof. Karl Camillo Schneider. Pp. viii+132. (Jena: G. Fischer, 1908.) Price 3 marks.

A COUPLE of years ago Prof. K. C. Schneider published six admirably clear and objective lectures as an introduction to the study of the evolution-theory. It was a useful exposition of the facts of variation and heredity, and of the Darwinian and Lamarckian interpretations. The present volume is critical and personal, and is not easy reading. We cannot do more than indicate the author's point of view. The first half of the book deals with stimulus, psyche and consciousness, subject and individuation, sensation and heredity, need and purpose, and Darwinism. The second half deals with mutation, potency, and structure; orthogenesis and extinction; trophic stimulus; vitality; entelechy and heritability; phylogeny, and the becoming of man.

The author's general position is closely akin to the positivism of Mach and Avenarius, which is, he thinks, the stable foundation for that part of the biological edifice that now requires building. Biologically he is perhaps nearest Weismann, but he believes that the psychical is the most important biological factor; he will not hear of the transmission of somatic modifications, but he believes that the transmigration of souls is almost self-evident. In discussing Lamarckism he points out that it has two sides; on the one hand, it is an erroneous theory of passive transformation conditioned by external stimulus; on the other hand, it is a true theory of the subjective response of a creative agent. He develops this second idea—which he calls by the extraordinary name of "Eulamarckism."

Prof. Schneider is a neo-vitalist who has the courage to say out and out that he believes in a specific vital energy, in a living substance. There are some who deny this, and maintain that life may be described as a succession of fermentations and the like, but this view ignores the phenomena of regulation and correlation, not to speak of memory and the power of profiting by experience. There are others who deny a living substance, and refer regulation and mental processes to an immaterial principle or agent, which deals directively with metabolism, though it is not of it. Schneider does not sympathise with either of these positions; he supposes a special vital substance, the vehicle of the specific vital energy, just as the ether is the medium for radiant energy. But this vital substance is not a particular kind of matter; it consists of psychical substances residing in the structural units of the organism. The relation between Psyche and Physis is illustrated by the mutual relations in thermochemical processes. The physical processes in the plasma, which are set going by stimuli, correspond to the chemical processes; the associated psychical energy corresponds to heat. On the one hand there is molecular movement, on the other there is cell-sensation. Life depends on the sensations of cells, as heat on the movements of molecules. As temperature is the intensity-factor of heat, structure is the intensity-factor of vitality, the measure of vital potency.

In a short notice it would not be for edification to try to expound the author's views on the four-dimensional character of consciousness or the law of the conservation of the psyche, or his theory that the mysterious process of assimilation represents a particular kind of gravitation, and that the psychical analogue of the force of cohesion is the entelechy or soul—the formative principle of the organism.

Prof. Schneider believes strongly in mutation, but the essential factor in species-formation is "*Descension*"—which means a thorough-going change in organisation, such as getting a notochord or gill-clefts. To study descensions is at present the most urgent task of ætiologists. What brings about a "Descension"? It is a step in the "entelechialen (synthetischen) Umprägung" which seems to be the most characteristic secret of the organism.

J. A. T.

OUR BOOK SHELF.

Arithmétique graphique. Les Espaces arithmétiques; leurs Transformations. By Gabriel Arnoux. Pp. xii+84. (Paris: Gauthier-Villars, 1908.) Price 3 francs.

THE title of this little work does not indicate, as the English reader might expect, another addition to the ever-growing list of treatises upon geometrical methods of calculation or the graphical solution of ordinary problems. It might rather be described as an essay upon the geometrical interpretation of the theory of numbers.

The author has attempted a systematic exposition of what may be called the geometry of abacs and magic squares. By an *arithmetical space* he understands the set of all points (in a geometrical space of any number of dimensions) the coordinates of which are integral, and he has worked out the properties of such point-systems. Many theorems true for con-

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